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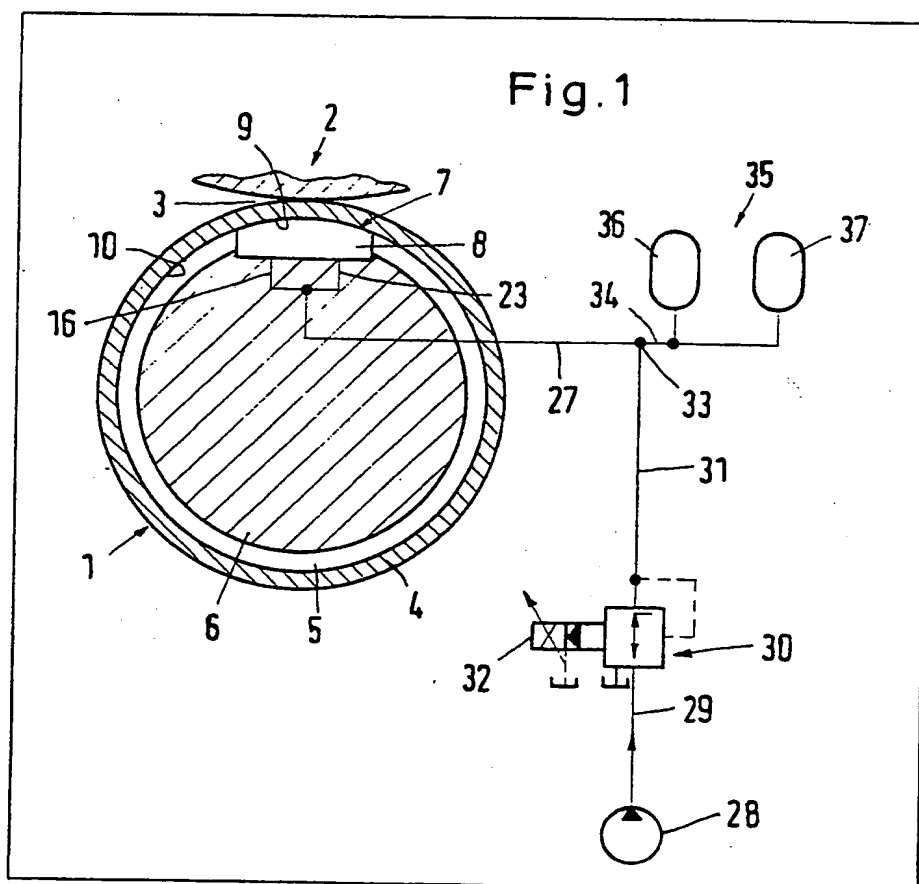
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(54) Hydrostatically supported roll

(57) In an hydrostatically supported roll (1), especially a pressure treatment roll, such as a calender roll, there is provided at least one bearing element (8), which has a bearing surface (9) provided with bearing pockets and is loaded by a pressure

transmitter, and a pressure medium feed device (28) which is connected with the pressure chamber of the pressure transmitter, if necessary via a pressure regulating device (30), and this chamber is connected with the bearing pockets. At least during the operation of the feed device (28), the pressure chamber is connected with an elastic pressure accumulator (35).



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Fig. 1

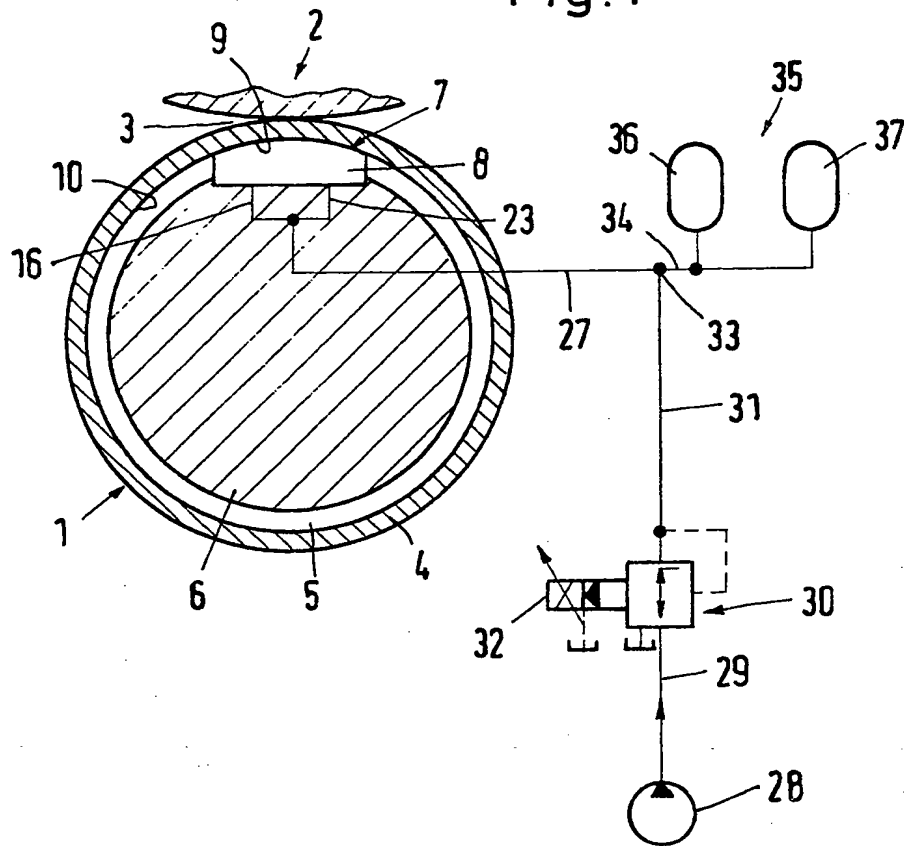


Fig. 2

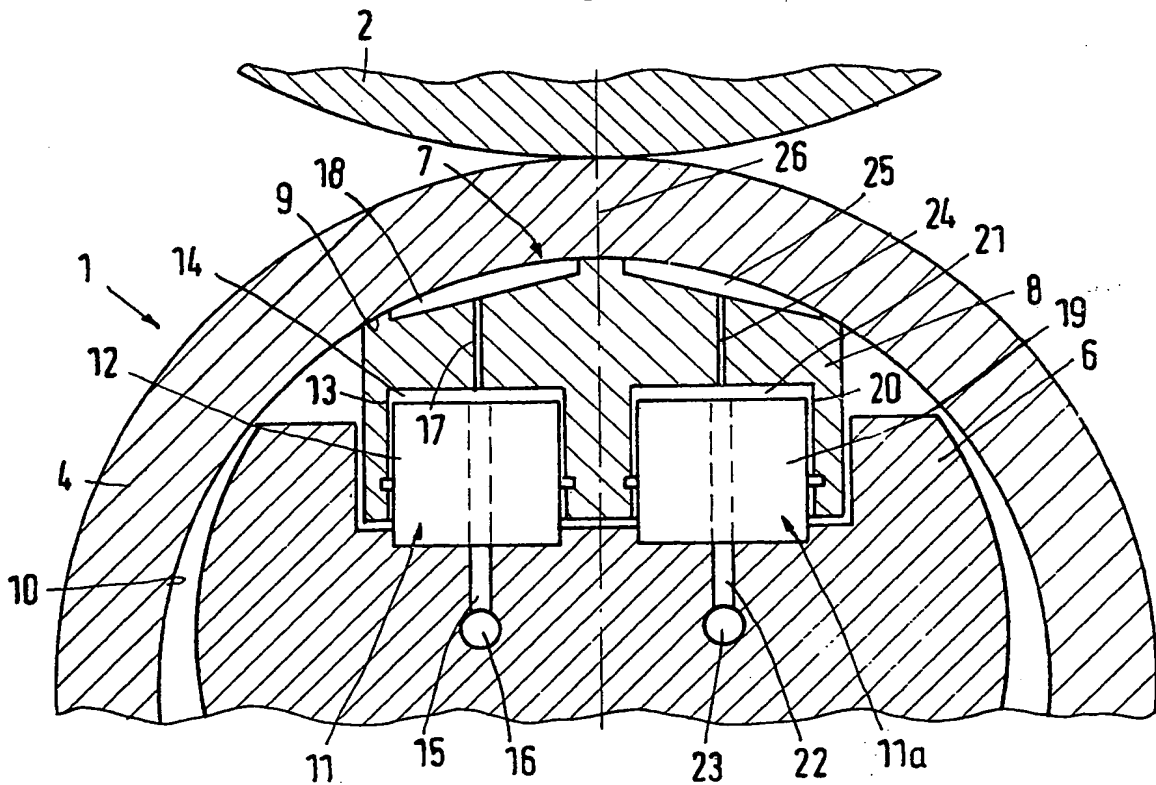
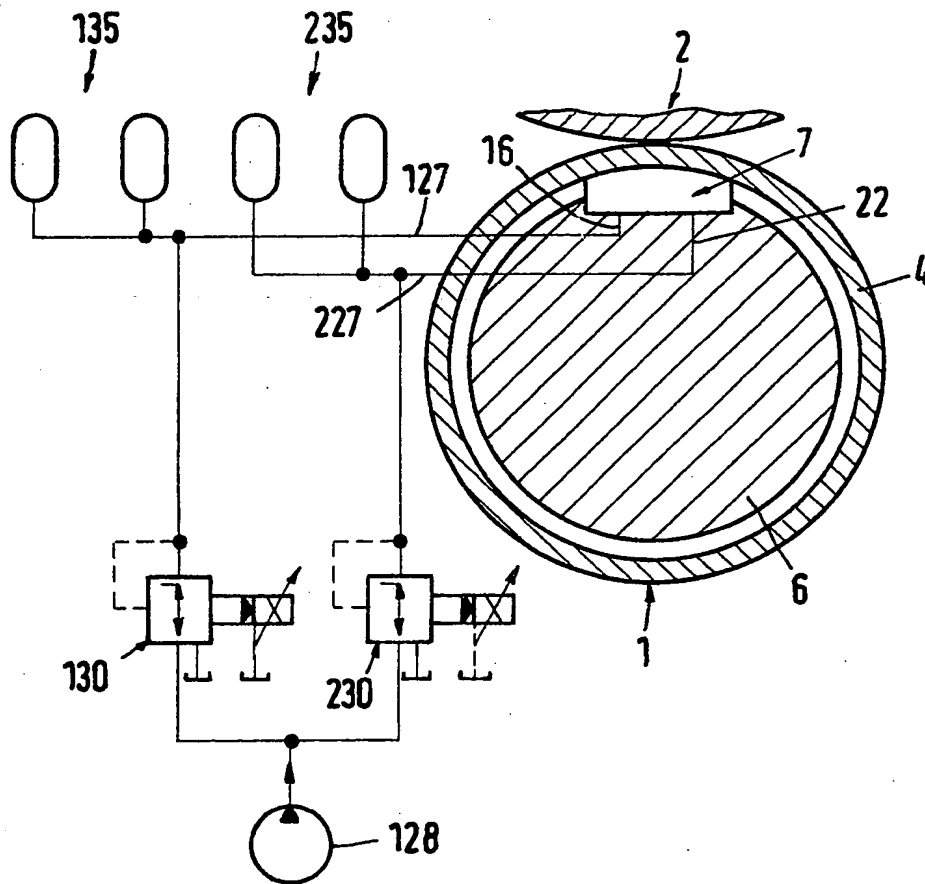


Fig. 3



SPECIFICATION

Hydrostatically supported roll

The invention relates to an hydrostatically supported roll, especially a pressure treatment roll such as a calender roll, in which at least one bearing element, having a bearing surface provided with bearing pockets, is loaded by a pressure transmitter, and a pressure medium feed device is connected with a pressure chamber of the pressure transmitter, if necessary via a pressure regulating device, and this chamber is connected with the bearing pockets. Such a roll is hereinafter referred to as of the kind described.

A known roll of this type (DE—OS 2,942,002) has a hollow roll shell through which a non-rotational support passes. The inner circumference of a roll shell is associated with the bearing surfaces, which contain pressure pockets of axially displaced bearing elements. Each bearing element is loaded by at least two pressure transmitters, the pressure chamber of each of which is defined by a cylinder formed in the bearing element and a piston which has a piston seal and is arranged on the support. Ducts between the pressure chamber and the bearing pocket in each case form a throttle point. In order to achieve deflection equalisation and shearing force compensation, the pressure transmitters of a bearing element and the pressure transmitters of axially displaced bearings elements can be supplied with different pressures.

When an hydrostatically supported roll of this type contains defects such as imbalances, variations in shape and position over its length or other deformations of the rotating parts, irrespective of whether they are present right from the start or whether they appear only during operation, for example, as a result of thermal expansion, the result is impact- and shock-like stresses or vibrations. This problem is particularly serious in pressure treatment rolls in which two rolls cooperate, or a larger number of rolls cooperate as in the case of many calenders. In this case, defects on other rolls or inhomogeneities in the product, in particular with regard to its distribution of mass, can in fact have shock or vibration inducing effects on the hydrostatically supported roll. Consequently, this leads to uncontrolled movements of the parts of the hydrostatic bearings, which can result in the cooperating surfaces of the bearing element and the roll touching one another. Furthermore, the seals on the pistons of the pressure transmitters are also adversely affected. This leads, therefore, to an increase in wear and tear which can result in impaired functioning of the hydrostatic bearings. Also, the surface of the rolls themselves and the quality of the products are impaired.

It is an object of the invention to provide an hydrostatically supported roll of the kind described in which shock, impact or vibrational movements of the roll do not have an adverse effect on the hydrostatic bearing, and in which the extent of these movements can even be reduced.

According to the invention, this object is

achieved in that the pressure chamber is connected to an elastic pressure accumulator, at least during the operation of the feed device.

Using the elastic pressure accumulator, the bearing element, by maintaining the pressure, can carry out a specific deflection movement when the bearing surface of the roll approaches the bearing element too closely. On the other hand, maintaining the bearing pressure, the bearing element can follow the bearing surface of the roll when the roll moves upwards. This works of the pressure accumulator leads simultaneously to damping of the detrimental roll displacement. The presence of the pressure accumulator does not adversely affect the work of a pressure regulating device, since the pressure accumulator automatically charges itself up to that level of pressure which the pressure regulating device has selected for the pressure transmitter.

Connecting the pressure accumulator into the hydraulic system of the hydrostatic bearing therefore eliminates from the roll the instabilities, vibrations, impacts and other undesirable movements which lead to pressure peaks and instability of the hydrostatic bearing system, or substantially damps them elastically. This contributes an improvement in the running of the machine parts and to protection of the roll surface. Elastic coverings, especially, are no longer stressed by hard pressure peaks. The elasticity in the bearings elements also eliminates damage to or destruction of elastic rolls which results from thermal stress and leads to an increase in the diameter. Furthermore the vibrations, pressure shocks and impacts which occur in the hydraulic system are also much reduced. Consequently, the seals on the pistons of the pressure transmitters are also protected from hard pressure peaks and thus from excessive wear. The working life is thus increased many times.

It is admittedly already known to provide an hydro-pneumatic pressure accumulator in hydrostatic bearings for rotating bodies (DE—AS 2,837,346). However, this pressure accumulator is connected with the input of an hydrostatic bearing block via a constant flow valve, forming a throttle point, and a non-return valve which is shut during normal operation. The purpose of this pressure accumulator is to continue to supply pressure medium to the bearing during failure of the feed pumps until the rotational body has been braked to a halt.

The hydraulic resistance between the pressure accumulator and the pressure chamber should be as small as possible so that the pressure accumulator and the pressure chamber can cooperate directly. In particular, a pipe between the pressure accumulator and the pressure chamber should have a smaller flow resistance than a pipe between the feed device or the pressure regulating device and the pressure chamber. The pipe can therefore have a shorter length and/or a larger cross-section. In particular, the pressure accumulator may be situated close up against the roll. It is recommended that the

pressure accumulator be directly connected with the pressure chamber, i.e., without using connecting valves or other regulating or control members.

5 If the bearing element is stressed by at least two pressure transmitters the pressure chambers of which can be supplied with pressure medium at different pressures, the pressure chambers should each be connected with an associated pressure
10 accumulator. In this way the shearing force compensation, which is designed to be achieved by the variation in pressure between the chambers, is not impaired.

Advantageously, an hydro-pneumatic pressure
15 accumulator is used. However, a pressure accumulator stressed by a mechanical spring is also suitable.

In many cases it is recommended to use a pressure accumulator consisting of several parallel
20 connected accumulator elements which are graded stepwise as to the level of the prestressing pressure. In this way it is possible to achieve a relatively wide effective range such as is required when the pressure regulating device operates with
25 a relatively wide range of pressures.

The invention is explained in more detail below by reference to preferred constructions of rolls in accordance with the invention and illustrated in the accompanying drawings, in which:

30 Fig. 1 shows a schematic representation of a first construction;

Fig. 2 is a partial section through an hydrostatic bearing for the Fig. 1 construction; and

35 Fig. 3 shows a schematic representation of a further construction.

In Fig. 1 two pressure treatment rolls 1 and 2 cooperate. These form a gap 3 through which is fed sheet material, e.g. paper, which is treated by the roll pressure. The roll 1 has a shell 4, through
40 the hollow chamber 5 of which a support 6, which is fixed to the carrier, passes. An hydrostatic bearing 7 has a bearing element 8 a bearing surface 9 of which rests against an inner circumference 10 of the roll shell 4.

45 Fig. 2 shows the design of such an hydrostatic bearing, as known per se. The bearing element 8 with its bearing surface 9 is pushed upwards by two pressure transmitters 11, 11A. The pressure transducer 11 has, a piston 12, fixed to the
50 support 6, which together with a cylinder 13 defines a pressure chamber 14 in the bearing element 8. This chamber is connected via an inlet duct 15 with a feed pipe 16 and via an outlet duct 17 with a bearing pocket 18 in the bearing surface
55 9. The pressure transmitter 11A has a piston 19, fixed to the support 6, which together with a cylinder 20 forms a pressure chamber 21 in the bearing element 8. This chamber is connected via an inlet duct 22 with a feed pipe 23 and via an
60 outlet duct 24 with a bearing pocket 25 in the bearing surface 9. The arrangement is symmetrical with respect to a centre plane 26.

In Fig. 1 the two feed pipes 16 and 23 are joined to a common feed line 27 leading to the
65 outside through the support 6. A continuously

operating feed pump 28 feeds pressure fluid via a pipe to a pressure regulating device 30 which, in a further section 31 of the pipe, regulates the pressure to a value which is predetermined by means of an adjusting device 32. This adjusting device can be set manually, remote controlled or adjusted through a control circuit in response to operating data from the roll or the products produced. At the point 33 there is connected a
70 further pipe 34 to which is connected an elastically operating pressure accumulator 35 consisting of two hydro-pneumatic pressure accumulator elements 36 and 37. Compared to the pipe 31, the pipe 34 is short and has a larger cross-section. The pipes 16, 23 and 27 also are constructed to be as short as possible and to have the largest possible cross-section. Consequently, it may be assumed that only insignificant flow losses will take place between the pressure chambers 14 and 21 and the pressure accumulator 35.
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The pressure accumulator elements 36 and 37, which in the non-stressed condition are graded stepwise as to the level of the prestressing pressure, are filled with pressure medium by means of the pump 28 until the gas spring contained therein has been compressed to the desired pressure corresponding to the initial pressure of the pressure regulating device 30. The adjusted pressure also exists in the pressure
90 chambers 14 and 21 or the pressure transmitters 11 and 11A. Through the output ducts 17 and 24 pressure medium flows continuously into the bearing pockets 18 and 25 respectively and from there to the outside via a gap formed between the bearing surface 9 and the circumferential surface 10. If the roll shell 4 now receives a shock in the region of the hydrostatic bearing 7, which shock forces it downwards, or if it is deflected inwardly, the shell does not contact the bearing surface 9
100 because the bearing element 8 can move downwards. The pressure medium thus displaced from the pressure chambers 14 and 21 is elastically absorbed by the pressure accumulator 35. Since throughout this the pressure remains practically unchanged, the full bearing force is maintained. In the same way the bearing element can follow upwards if the roll shell 2 should be moved upwards as a result of an external shock. The pressure chambers 14 and 21 are thus filled from the pressure accumulator while maintaining the bearing pressure. Since the bearing pressure is maintained, the return movement downwards of the roll 2 is also damped, thereby preventing an excitation of vibrations.
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In the construction according to Fig. 3, the design of the pressure rolls 1 and 2 as well as of the hydrostatic bearing 7 is unchanged. However, the feed pipes 16 and 22 leading to the two pressure transmitters are each provided with their own pipes 127 and 227, their own pressure regulating devices 130 and 230, as well as their own pressure accumulators 135 and 235. Only the pump 128 is common to both. In this way the pressure accumulators can be used without losing the advantages which are achieved by the
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separate pressure control for the pressure chambers 14 and 21.

If only one pressure transmitter is used, a pressure accumulator connection according to Fig. 1 is sufficient. If more than two pressure transmitters are present, they can both be connected to one pipe 27, and a pressure accumulator 35 can be provided. However, as shown in Fig. 3, it is also possible to arrange separate pipes and pressure accumulators. Finally, it is also possible to provide each separately controllable system with its own feed pump.

CLAIMS

1. An hydrostatically supported roll in which at least one bearing element, having a bearing surface provided with bearing pockets, is loaded by a pressure transmitter and a pressure medium feed device is connected with a pressure chamber of the pressure transmitter, if necessary via a pressure regulating device, and this chamber is connected with the bearing pockets, characterised in that the pressure chamber is connected with an elastic pressure accumulator, at least during the operation of the feed device.
2. A roll according to claim 1, characterised in that a pipe between the pressure accumulator and

the pressure chamber has a smaller flow resistance than a pipe between the feed device or the pressure regulating device and the pressure chamber.

3. A roll according to claim 1 or claim 2, characterised in that the pressure accumulator is directly connected with the pressure chamber.

4. A roll according to any one of the preceding claims, in which the bearing element is stressed by at least two pressure transmitters, the pressure chambers of which are arranged to be supplied with a pressure medium at different pressures, characterised in that the pressure chambers are each connected with an associated pressure accumulator.

5. A roll according to any one of the preceding claims, characterised in that the pressure accumulator is an hydro-pneumatic pressure accumulator.

6. A roll according to any one of the preceding claims, characterised in that the pressure accumulator consists of several parallel connected accumulator elements which are graded stepwise as to the level of the prestressing pressure.

7. An hydrostatically supported roll substantially as described with reference to either one of the constructions illustrated in the accompanying drawings.